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Title: 2011 Los Alamos National Laboratory Riparian Inventory Results

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Executive Summary

A total length of 36.7 kilometers of riparian habitat were inventoried within LANL boundaries between 2007 and 2011. The following canyons and lengths of riparian habitat were surveyed and inventoried between 2007 and 2011. Water Canyon (9,669 m), Los Alamos Canyon (7,131 m), Pajarito Canyon (6,009 m), Mortandad Canyon (3,110 m), Two-Mile Canyon (2,680 m), Sandia Canyon (2,181 m), Three-Mile Canyon (1,883 m), Canyon de Valle (1,835 m), Ancho Canyon (1,143 m), Cañada del Buey (700 m), Sandia Canyon (221 m), DP Canyon (159 m) and Chaquehui Canyon (50 m). Effluent Canyon, Fence Canyon and Potrillo Canyon were surveyed but no areas of riparian habitat were found.

Stretches of inventoried riparian habitat were classified for prioritization of treatment, if any was recommended. High priority sites included stretches of Mortandad Canyon, LA Canyon, Pajarito Canyon, Two-Mile Canyon, Sandia Canyon and Water Canyon. Recommended treatment for high priority sites includes placement of objects into the stream channel to encourage sediment deposition, elimination of channel incision, and to expand and slow water flow across the floodplain. Additional stretches were classified as lower priority, and, for other sites it was recommended that feral cattle and exotic plants be removed to aid in riparian habitat recovery.

Introduction

In 2005, the Environmental Protection Agency identified protection and restoration of riparian areas as a key strategy to reduce nonpoint source pollution in the United States (USEPA 2005). Riparian areas filter surface water, subsurface flow, and groundwater flow, preventing or trapping the entry of sediment, sediment-bound pollutants, and nutrients into waterbodies. Enhancement of riparian areas is one of the strategies LANL is using to slow runoff velocity and reduce the transport of sediments and associated historic released contaminants off-site. In addition, vegetative communities associated with wetlands or riparian areas provide important resources for wildlife living in the region and contribute disproportionately to biodiversity. LANL biologists began inventorying riparian areas at LANL in 2007 as part of the implementation of LANL's Biological Resources Management Plan.

The goals of LANL's Riparian Area Inventory are to:

- Map locations of all distinct riparian vegetative community occurrences within LANL boundaries.
- Classify community type and assess functioning condition of each occurrence.
- Identify contributing risk factors for areas not functioning properly or at risk.
- Identify areas within the scope of the inventory where riparian area management could reduce risks of contaminant transport.

In 2007, LANL biologists inventoried riparian areas in Mortandad Canyon, Los Alamos Canyon and portions of Sandia Canyon. During 2008 and 2009, LANL biologists

inventoried riparian areas in Two-Mile Canyon, Cañada del Buey, DP Canyon, Effluent Canyon, and Potrillo Canyon, and in portions of Water Canyon, Sandia Canyon, Pajarito Canyon (including Starmer's Gulch and Bulldog Gulch), and Ancho Canyon. Effluent Canyon and Potrillo Canyon had no riparian areas.

During 2011, LANL biologists inventoried remaining riparian areas in Three-Mile Canyon, Cañon de Valle, Pajarito Canyon, Water Canyon and Chaquehui Canyon and Ancho Canyon as well as a site revisit to DP Canyon. Funding for these surveys was provided by the Biological Resources Management Plan Implementation.

Scope of Riparian Area Inventory:

Riparian areas are areas exhibiting vegetation or physical characteristics indicating long-term surface or subsurface water influence. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil (USDI BLM 1998). The U.S. Fish and Wildlife Service (USFWS) defines riparian areas in the western United States as follows (USFWS NWI 1997):

Riparian areas have one or both of the following characteristics: 1) distinctly different vegetative species than adjacent areas, and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms.

Wetlands are a specific category of riparian area. Wetlands at LANL were inventoried in 2005 by a team of subject matter experts from the U.S. Army Corps of Engineers Albuquerque District (Green et al. 2005). Areas delineated as wetlands in 2005 were not included in this riparian area inventory effort.

For the purposes of this inventory effort, we considered primarily riparian areas that have characteristic number one of the USFWS definition (distinctly different vegetation than adjacent areas).

Minimum Mapping Unit: 0.1 ha (10m x 10m, or 100m²); no area was inventoried unless it was at least 5 m in width (including up to 1 m for stream channel); if 5 m wide, the area must be at least 20 m long.

Number of Plots: If a community occurrence of a riparian vegetative community is less than 0.25 mi (400 m) long, one plot was used to characterize it. If it is longer than 0.25 mi, then more plots were added. *An exception to the procedure was made for the 2011 surveys. The last of the riparian surveys were conducted in 2011 with limited funding levels; therefore, the distance between plots in reaches greater than 400m was increased to limit the number of plots measured. Additionally, access to some of the more remote canyons (e.g., Upper Water Canyon) was restricted and further limited the number of plots that could be recorded in these areas. In general for 2011 surveys, a new plot was conducted where there was a clear visual change in the riparian vegetation composition.*

A detailed description of field methods can be found in the procedure “EAQ-217 Riparian Area Inventory”, or subsequent revisions of this procedure. Data, including geospatial data, for this inventory is maintained in the BRMP database, currently located at \\win\eshq\Common\BIO\BRMP_Geodatabase

Summary of Recommendations

Of the 15 stretches of riparian surveyed in 2011, four are categorized as high priority for treatment (Table 1), and three are categorized as lower priority, including one stretch recommended for exotic plant and feral cattle removal.

Table 1: Summary of recommendations for high priority and lower priority riparian sites

Recommended Treatment	Site Name
High Priority	
Placement of obstacles (such as snags) into stream channel to encourage sediment deposition, eliminate channel incision, and expand and slow water flow across floodplain.	Lower Pajarito 8, Upper Water Middle Water Lower Water 1 and 2
Lower Priority	
Placement of obstacles (such as snags) into stream channel to encourage sediment deposition, and eliminate channel incision.	Lower Pajarito 5, Lower Pajarito 6
Remove exotic plants and feral cattle	Chaquehui

Community Type Naming Convention

We used the naming conventions of the U. S. National Vegetation Classification to identify the community types (associations) of our riparian vegetation communities. However, our confidence in our plant identifications are low to moderate (especially for grasses and forbs), and these names generally do not represent recognized associations in the NatureServe (2009) database.

Additionally, the surveys in 2011 were conducted in May, June and August 2011, during which time New Mexico was in a state of severe drought. This drought state was measured using the Palmer Drought Severity Index (PDSI) which uses a combination of temperature and precipitation data over several months as indicators of long-term meteorological drought. In New Mexico, May to August 2011 had a PDSI value of -4.99, second only to the 1904 record of -5.33 in the entire period of record beginning in 1895. These dry conditions led to a lack or delay of grass and forb growth and flowering, and delayed leaf-out in some shrubs, further complicating some plant identifications (especially for grasses and forbs). Mountain muhly was tentatively identified in 11 of the 14 plots surveyed in 2011; though the confidence in this identification is low due to the very dry conditions of the sites and the fact that mountain muhly is not typically associated with riparian areas. Therefore, grasses identified as mountain muhly in the field, were entered into the database as unknown grass (UNKG1).

Identified Community Types

Coyote Willow – Skunkbush Sumac Wooded Shrubland (*Salix exigua* – *Rhus trilobata* Wooded Shrubland)

Plot: Lower Pajarito Canyon 5

Provisional description: Box elder and rocky mountain juniper comprise <25 percent overstory canopy. The shrub layer is a mix of skunkbush sumac and coyote willows. Mixed grasses are comprised of blue gramma, mountain muhly, fringed brome and slender wheatgrass. Litter is moderate to high. *Note: This community type may not meet the definition of riparian in the sense of having 25 percent relative cover of a FAC, FACW or OBL wetland species. However, the presence of box elder and some willow are distinctly different vegetatively than adjacent areas.*

Narrowleaf Cottonwood – Box Elder / Mixed Grasses Woodland (*Acer negundo* – *Populus angustifolia* / Mixed Grasses Woodland)

Plot: Lower Pajarito Canyon 6

Provisional description: Total overstory is >25 percent and < 60 percent composed of riparian-associated species such as box elder and narrowleaf cottonwood. Few shrubs are present in the understory; species include New Mexico olive, Rocky Mountain juniper, skunkbush sumac, and sagebrush species. Litter cover is moderate to high.

Narrowleaf Cottonwood – Ponderosa Pine / Skunkbush Sumac Woodland (*Populus angustifolia* – *Pinus ponderosa* / *Rhus trilobata* Woodland)

Plot: Lower Pajarito Canyon 7 Plot 1

Provisional description: Total overstory is >25 percent and <60 percent and is comprised of narrowleaf cottonwood and Ponderosa pine. Rocky Mountain juniper and coyote willow may be present. Skunkbush sumac is dominant or codominant in the shrub layer. Litter cover is high.

Mixed Grasses Wooded Herbaceous Vegetation

Plot: Lower Pajarito Canyon 7 Plot 2

Provisional description: Total overstory canopy is <25 percent and is comprised primarily of narrowleaf cottonwood. Some box elder, willow and Russian olive are present. The ground cover layer of the understory is comprised of a mix of grasses including little bluestem and red brome. Litter cover is high. *Note: This community type may not meet the definition of riparian in the sense of having 25*

percent relative cover of a FAC, FACW or OBL wetland species. However, the presence of narrowleaf cottonwood, box elder and some willow are distinctly different vegetatively than adjacent areas.

Narrowleaf Cottonwood – Box Elder / Skunkbush Sumac Woodland (*Populus angustifolia* – *Acer negundo* / *Rhus trilobata* Woodland)

Plot: Lower Pajarito Canyon 8

Provisional description: Total overstory canopy is >25 percent and <60 percent and comprised of riparian-associated species box elder and narrowleaf cottonwood. Skunkbush Sumac is dominant in the shrub layer. *Artemisia* sp. may also occur. The ground cover layer of the understory is comprised of a mix of grasses including blue gramma, and red brome. Litter cover is high.

Mixed Conifer – Water Birch / Gambel Oak Forest (Mixed Conifer – *Betula occidentalis* / *Quercus gambelli* Forest)

Plot: Pajarito Canyon TA-40 Plot 1

Provisional description: Total overstory canopy is >60 percent and is comprised of riparian-affiliated species such as water birch, and mixed conifers such as Douglas fir and Ponderosa pine. The shrub layer of the understory is moderate and is comprised of Gambel oak and coyote willows. Litter cover is high.

Mixed Conifer / Gambel Oak Forest (Mixed Conifer / *Quercus gambelli* Forest)

Plot: Pajarito Canyon TA-40 Plot 2

Provisional description: Total overstory canopy is >60 percent and is comprised of mixed conifers such as Douglas fir, Ponderosa pine and White fir. The shrub layer of the understory is moderate. Trees or shrub forms of Gambel oak are present. Coyote willow may also occur. Litter cover is high. *Note: This community type may not meet the definition of riparian in the sense of having 25 percent relative cover of a FAC, FACW or OBL wetland species. However, in the Los Alamos area, occurrences of mixed conifer at lower elevations are specifically associated with stream channels, and are distinctly different vegetatively than adjacent areas.*

Water Birch – Mixed Conifer / Gambel Oak Forest (*Betula occidentalis* – Mixed Conifer / *Quercus gambelii* Forest)

Plot: Upper Water Canyon

Provisional description: Total overstory canopy is >60 percent and is comprised of water birch and mixed conifers including Douglas fir and white fir. The understory shrub layer contains Gambel oak. Litter cover is high.

Box Elder –Water Birch / Poa sp. Forest (*Acer negundo* – *Betula occidentalis* / *Poa* sp. Forest)

Plot: Middle Water Canyon

Provisional description: Total overstory tree cover is > 60 percent and is comprised of riparian-associated species box elder, with a diagnostic occurrence of water birch. There are few shrubs and the understory ground cover is a mix of grasses including muttongrass, red brome and other brome species. There is little to no litter cover.

Ponderosa Pine – Box Elder / Brome sp. Woodland (*Pinus ponderosa* – *Acer negundo* / *Bromus* sp. Woodland)

Plot: Lower Water Canyon Plot 1

Provisional description: Total overstory cover is >25 percent and <60 percent and is comprised of Ponderosa pine and box elder. There are few juniper shrubs and few grasses and forbs. Litter cover is moderate to high.

Mixed Conifer – Box Elder / Fendler's Barberry – Skunkbush Sumac Forest (Mixed Conifer – *Acer negundo* / *Berberis fendleri* – *Rhus trilobata* Forest)

Plot: Lower Water Canyon Plot 2

Provisional description: Total overstory tree cover is >60 percent and is comprised of mixed conifers and box elder. There is also some narrowleaf cottonwood and water birch. The shrub component of the understory is moderate and is comprised of Fendler's barberry and skunkbush sumac. Litter cover is high.

Mixed Conifer – Box Elder / Gambel Oak Forest (Mixed Conifer – *Acer negundo* / *Quercus gambelii* Forest)

Plot: Canyon de Valle

Provisional description: Overstory tree canopy is > 60 percent and is comprised of Douglas fir as well as riparian-associated box elder. There are Gambel oak in the shrub component of the understory and the ground cover component of the understory is a mix of grasses and forbs. Litter cover is high.

Narrow-leaf Cottonwood - Rocky Mountain Juniper / Mixed Grasses Woodland (*Populus angustifolia* - *Juniperus scopulorum* / Mixed Grasses Woodland)

Plot: Three-Mile Canyon

Provisional description: Overstory tree cover is >25 percent but <60 percent and is comprised of narrowleaf cottonwood which is a riparian-associated species. There is a lower overstory layer of Rocky Mountain juniper. Willows may also be present. The understory ground cover is a mix of grasses, rushes and forbs. Litter cover is high.

Mixed Conifer – Box Elder / Gambel Oak Woodland (Mixed Conifer – *Acer negundo* / *Quercus gambelii* Woodland)

Plot: Three-Mile-2 Canyon

Provisional description: Overstory tree cover is >25 percent but < 60 percent and is comprised of mixed conifers including Ponderosa pine and Douglas fir along with box elder which is a riparian-associated species. There are willows, Gambel oak, New Mexico locust and Colorado barberry in the shrub understory. Litter cover is high.

Box Elder – Narrowleaf Cottonwood Forest (*Acer negundo* – *Populus angustifolia* Forest)

Plot: Chaquehui Canyon

Provisional description: Overstory tree cover is >60 percent and is comprised of narrowleaf cottonwood and box elder. The shrub layer may contain non-native species including Salt Cedar (*Tamarisk* spp) and Russian olive (*Elaeagnus angustifolia*).

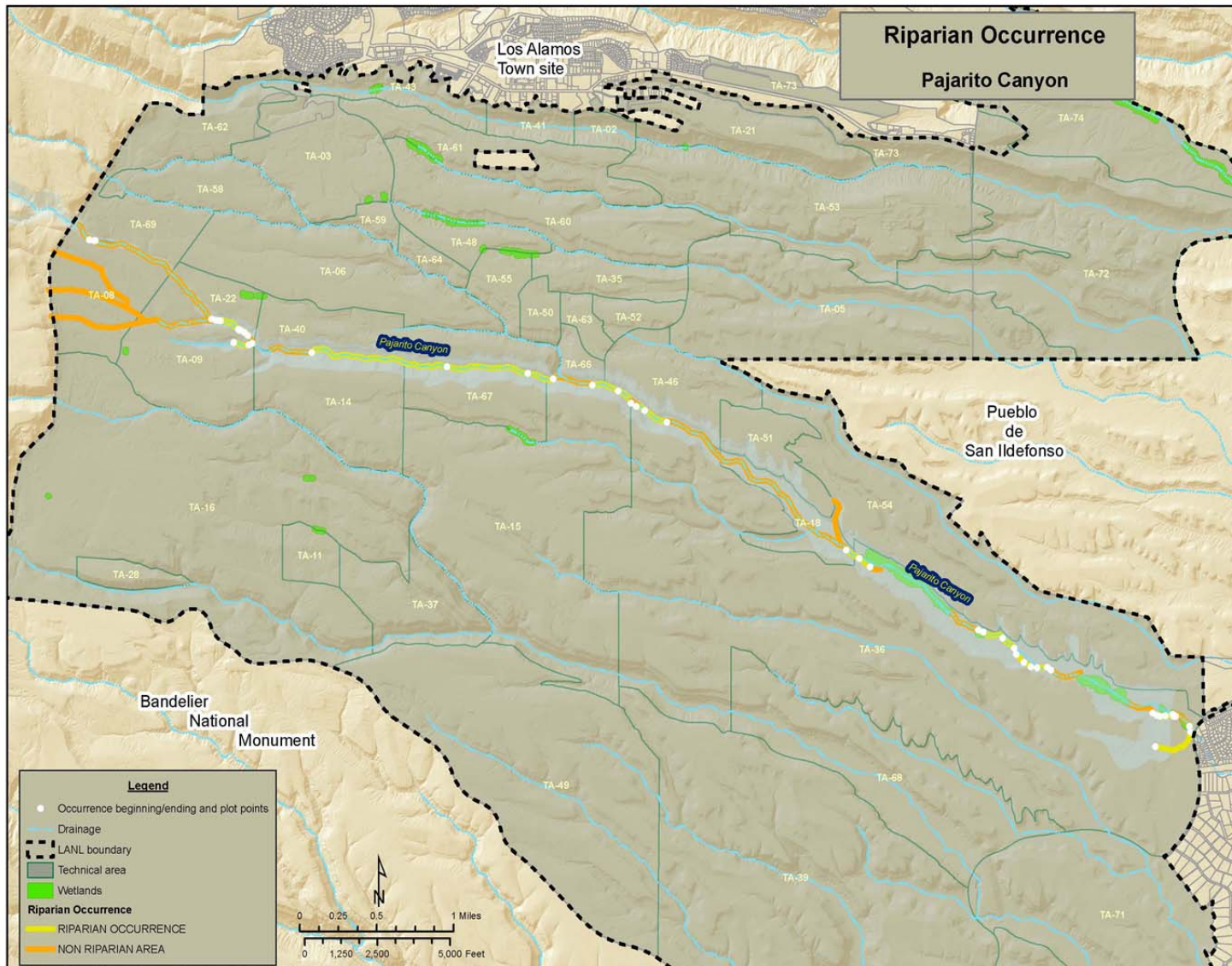


Figure 1: Riparian occurrences and non-riparian surveyed in Pajarito Canyon in 2011

Pajarito Canyon

In 2008 and 2009 approximately 70 percent of Pajarito Canyon riparian communities were inventoried. These areas included Upper Pajarito Canyon, areas above and below the Flood Retention Structure (FRS), areas of Lower Pajarito Canyon and Bulldog Gulch Tributary.

In 2011 the remaining 30 percent of Pajarito Canyon was surveyed; completing the riparian inventory in Pajarito Canyon. Areas surveyed in 2011 were in Lower Pajarito Canyon.

Riparian Community Occurrence Site Lower Pajarito Canyon 5



Photographs 1 and 2: Riparian occurrence site lower Pajarito Canyon 5 facing east and west, respectively.

Community Type: Coyote Willow – Skunkbush Sumac Wooded Shrubland (*Salix exigua* – *Rhus trilobata* Wooded Shrubland)

Length: 156 m

Functional Condition: Functional

Data Summary:

Plot: Lower Pajarito 5 5/24/2011

Measurement		Value
Width of riparian occurrence (m)		10
Avg. width of unvegetated stream channel (m)		1.8
Total overstory canopy cover (percent)		14
Overstory tree cover by species (percent)	ACNE	8
	JUSC	6
Tree Density by species	ACNE	100/ha
	JUSC	100/ha

Avg. tree DBH by species (cm)	ACNE JUSC	15 11
Avg. tree height by species (m)	ACNE JUSC	6.1 3.8
Snag Density		0
Understory height (m)	#Points with veg Min Max Avg	3 of 10 1 1.4 1.3
Total understory cover by species (percent)	BOGR UNKG1 RHTR SAEX ACNE AGTR, ARBI, BRCI	20 18 12 16 6 <5
Ground surface covered by live understory vegetation (percent)		66
Ground surface covered by litter (percent)		66

Comments: Russian Olive (*Elaeagnus angustifolia*) was present. Disturbances influencing current riparian areas functioning include soil deposition, upstream channel conditions and channelization. Riparian-wetland plants do not exhibit high vigor.

Recommendations: Consider this riparian community occurrence for in-channel placement of mechanical obstacles (such as snags) that would reduce flow rates.

Riparian Community Occurrence Site Lower Pajarito Canyon 6



Photographs 3 and 4: Riparian occurrence site lower Pajarito Canyon 6 facing east and west, respectively.

Community Type: Narrowleaf Cottonwood – Box Elder / Mixed Grasses Woodland (*Acer negundo* – *Populus angustifolia* / Mixed Grasses Woodland)

Length: 205 m

Functional Condition: Functional – at risk

Data Summary:

Plot ID Lower Pajarito 6 5/24/2011

Measurement		Value
Width of riparian occurrence (m)		10
Avg. width of unvegetated stream channel (m)		2.25
Total overstory canopy cover (percent)		56
Overstory tree cover by species (percent)	ACNE POAN2	30 26
Tree Density by species	ACNE POAN2	200/ha 100/ha
Avg. tree DBH by species (cm)	ACNE POAN2	14.0 9.6
Avg. tree height by species (m)	ACNE POAN2	7.1 2.6
Snag Density		100/ha
Understory height (m)	#Points with veg Min Max Avg	4 of 10 0.1 3.0 0.9
Total understory cover by species (percent)	UNKG1 JUSC ACNE, CLCOC2, FONE, RUTR, SAEX	20 8 <5
Ground surface covered by live understory vegetation (percent)		36
Ground surface covered by litter (percent)		78

Comments: Russian Olive (*Elaeagnus angustifolia*) was present. Riparian-wetlands plants do not exhibit high vigor. There is excessive erosion and the stream is not in balance with the water and sediment being supplied by the watershed.

Recommendations: Consider this riparian community occurrence for in-channel placement of mechanical obstacles (such as snags) that would reduce flow rates. Consider stabilizing adjacent upland.

Riparian Community Occurrence Site Lower Pajarito Canyon 7-1



Photographs 5 and 6: Riparian occurrence site lower Pajarito Canyon 7 Plot 1 facing east and west, respectively.

Community Type: Narrowleaf Cottonwood – Ponderosa Pine / Skunkbush Sumac Woodland (*Populus angustifolia* – *Pinus ponderosa* / *Rhus trilobata* Woodland)

Length: 1000 m

Functional Condition: Functional

Data Summary:

Plot: Lower Pajarito 7 Plot 1 5/25/2011

Measurement		Value
Width of riparian occurrence (m)		18
Avg. width of unvegetated stream channel (m)		1
Total overstory canopy cover (percent)		60
Overstory tree cover by species (percent)	JUSC	4
	PIPO	20
	POAN2	36
Tree Density by species	POAN2	500
Avg. tree DBH by species (cm)	POAN2	21
Avg. tree height by species (m)	POAN2	8.5
Snag Density		0
Understory height (m)	#Points with veg	7 of 10
	Min	0.2
	Max	2.5
	Avg	1.1
Total understory cover by species (percent)	UNKG1	24
	RHTR	10
	SAEX	8
	BOGR	8
	ARBI	8
	RUTR, SCSC,	

	JUMO, BRRU2	<5
Ground surface covered by live understory vegetation (percent)		58
Ground surface covered by litter (percent)		94

Comments: There is flow regulation upstream.

Recommendations: None.

Riparian Community Occurrence Site Lower Pajarito Canyon 7-2



Photographs 7 and 8: Riparian occurrence site lower Pajarito Canyon Plot 2 facing east and west, respectively.

Community Type: Mixed Grasses Wooded Herbaceous Vegetation

Length: 1530 m

Functional Condition: Functional

Data Summary:

Plot: Lower Pajarito 7 Plot 2 5/25/2011

Measurement		Value
Width of riparian occurrence (m)		26
Avg. width of unvegetated stream channel (m)		1.5
Total overstory canopy cover (percent)		14
Overstory tree cover by species (percent)	POAN2	14
Tree Density by species	ACNE	100/ha
	ELAN	100/ha
	POAN2	100/ha
Avg. tree DBH by species (cm)	ACNE	4.1
	ELAN	8.6
	POAN2	32

Avg. tree height by species (m)	ACNE ELAN POAN2	3.5 4.9 11
Snag Density		200/ha
Understory height (m)	#Points with veg Min Max Avg	9 of 10 0.1 1.4 0.4
Total understory cover by species (percent)	UNKG1 JUMO UNK1 SCSC FAPA, SAEX, JUSC, G1, F1, BRRU2	64 10 8 6 <5
Ground surface covered by live understory vegetation (percent)		78
Ground surface covered by litter (percent)		82

Comments: There is flow regulation upstream

Recommendations: None.

Riparian Community Occurrence Site Lower Pajarito Canyon 8



Photographs 9 and 10: Riparian occurrence site lower Pajarito Canyon 8 facing east and west, respectively.

Community Type: Narrowleaf Cottonwood – Box Elder / Skunkbush Sumac Woodland (*Populus angustifolia* – *Acer negundo* / *Rhus trilobata* Woodland)

Length: 304 m

Functional Condition: Functional -At Risk

Data Summary:

Plot: Lower Pajarito Canyon 8 6/6/2011

Measurement		Value
Width of riparian occurrence (m)		26
Avg. width of unvegetated stream channel (m)		4.5
Total overstory canopy cover (percent)		44
Overstory tree cover by species (percent)	ACNE POAN2	22 22
Tree Density by species	ACNE POAN2	200/ha 100/ha
Avg. tree DBH by species (cm)	ACNE POAN2	17 37
Avg. tree height by species (m)	ACNE POAN2	6.3 11
Snag Density		0
Understory height (m)	#Points with veg Min Max Avg	4 of 10 0.1 2.3 1.2
Total understory cover by species (percent)	UNKG1 RHTR BOGR UNKG2 ARCA1 VETH, BRRU2, ARDR	22 20 10 8 8 <5
Ground surface covered by live understory vegetation (percent)		54
Ground surface covered by litter (percent)		80

Comments: Adjacent upland watershed is contributing to riparian degradation. Floodplain and channel characteristics, including riparian vegetation and rocks/woody debris, are not adequate to protect banks and dissipate energy during high flows. The stream channel lacks natural sinuosity and vertical stability. The stream is not in balance with the water and sediment being supplied by the watershed. Banks collapse and excessive erosion were observed during survey.

Recommendations: Consider this riparian community occurrence for in-channel placement of mechanical obstacles (such as snags) that would reduce flow rates. Consider stabilizing adjacent upland.

Riparian Community Occurrence Site Pajarito Canyon TA-40-1



Photographs 11 and 12: Riparian occurrence site Pajarito Canyon TA-40 Plot 1 facing east and west, respectively.

Mixed Conifer – Water Birch / Gambel Oak Forest (Mixed Conifer – *Betula occidentalis* / *Quercus gambelii* Forest)

Length: 292 m

Functional Condition: Functional

Data Summary:

Plot: Pajarito TA-40 Plot 1 5/31/2011

Measurement		Value
Width of riparian occurrence (m)		10
Avg. width of unvegetated stream channel (m)		1.95
Total overstory canopy cover (percent)		86
Overstory tree cover by species (percent)	BEOC	8
	PSME	34
	QUGA	16
	SAEX	26
Tree Density by species	BEOC	400/ha
	PIPO	200/ha
	PSME	300/ha
	QUGA	600/ha
	SAEX	500/ha
Avg. tree DBH by species (cm)	BEOC	5.4
	PIPO	11
	PSME	14
	QUGA	10
	SAEX	2.3

Avg. tree height by species (m)	BEOC PIPO PSME QUGA SAEX	5.9 8.2 9.4 7 4
Snag Density		0
Understory height (m)	#Points with veg Min Max Avg	5 of 10 0.1 0.2 0.12
Total understory cover by species (percent)	UNKG1 UNKG2 F1 POFE SCSC, TORA	26 14 6 6 <5
Ground surface covered by live understory vegetation (percent)		48
Ground surface covered by litter (percent)		94

Comments: None.

Recommendations: None

Riparian Community Occurrence Site Pajarito Canyon TA-40-2



Photographs 13 and 14: Riparian occurrence site Pajarito Canyon TA-40 Plot 2 facing east and west, respectively.

Community Type: Mixed Conifer / Gambel Oak Forest (Mixed Conifer / *Quercus gambelli* Forest)

Length: 145 m

Functional Condition: Functional

Data Summary:

Plot: Pajarito TA40 Plot 2 5/31/2011

Measurement		Value
Width of riparian occurrence (m)		12
Avg. width of unvegetated stream channel (m)		1.75
Total overstory canopy cover (percent)		70
Overstory tree cover by species (percent)	ABCO	18
	PSME	14
	QUGA	16
	SAEX	22
Tree Density by species	ABCO	300/ha
	SAEX	400/ha
Avg. tree DBH by species (cm)	ABCO	16
	SAEX	3.2
Avg. tree height by species (m)	ABCO	13
	SAEX	4.3
Snag Density		100/ha
Understory height (m)	#Points with veg	5 of 10
	Min	0.1
	Max	1.5
	Avg	0.46
Total understory cover by species (percent)	UNKG1	40
	UNKG2	12
	F1, PRVI, QUGA,	
	TORA	<5
Ground surface covered by live understory vegetation (percent)		54
Ground surface covered by litter (percent)		76

Comments: None.

Recommendations: None

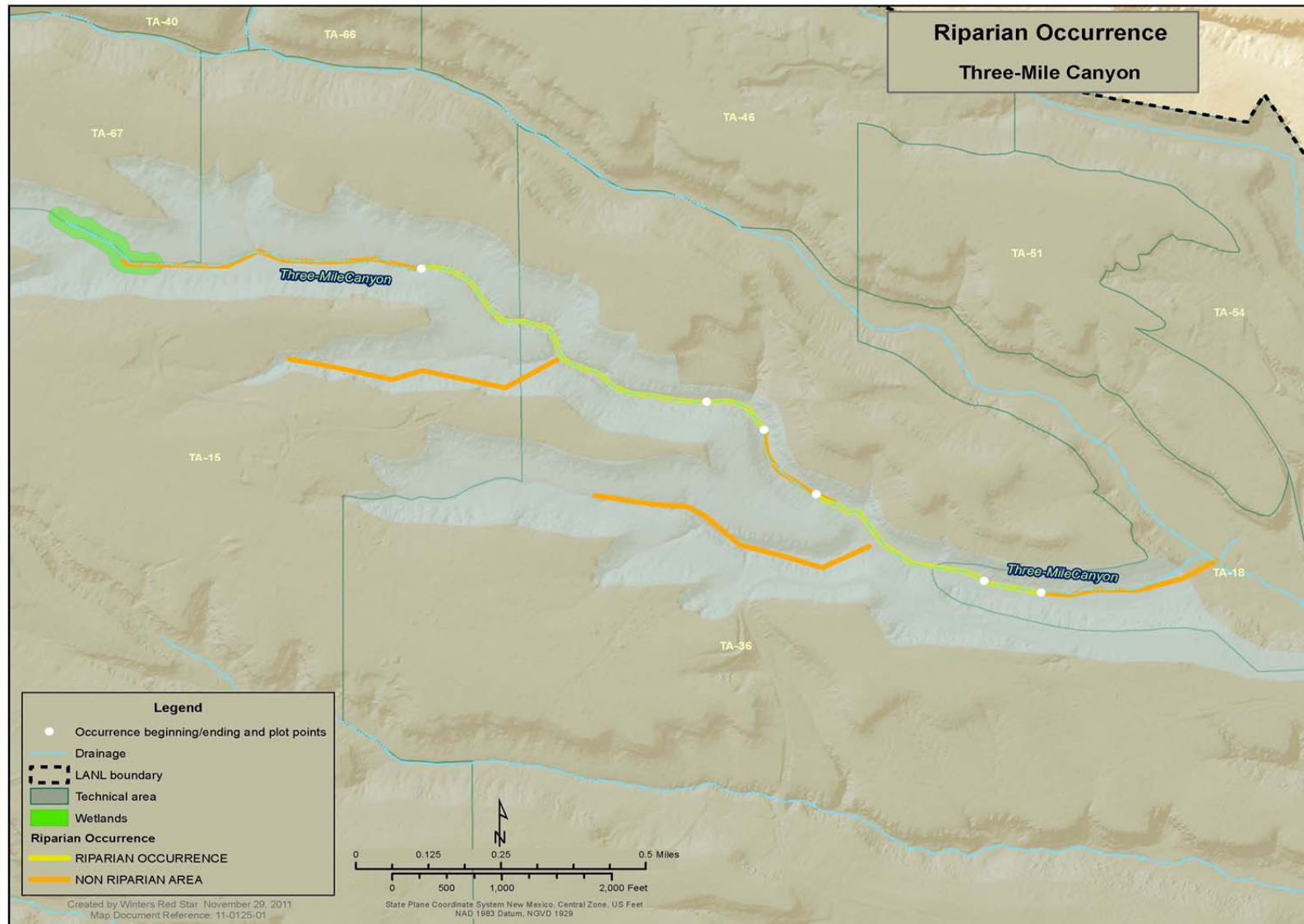


Figure 2: Riparian occurrences and non-riparian surveyed in Three-Mile Canyon in 2011

Three-Mile Canyon

In 2011 LANL biologists completed an inventory of riparian community occurrences in Three-Mile Canyon.

Riparian Community Occurrence Three-Mile Canyon



Photographs 15 and 16: Riparian occurrence site Three-Mile Canyon facing east and west, respectively.

Community Type: Narrow-leaf cottonwood - Rocky Mountain Juniper / Mixed Grasses Woodland (*Populus angustifolia* - *Juniperus scopulorum* / Mixed Grasses Woodland)

Length: 709 m

Functional Condition: Functional

Data Summary:

Plot: Three-Mile Canyon 6/6/2011

Measurement		Value
Width of riparian occurrence (m)		48
Avg. width of unvegetated stream channel (m)		1.5
Total overstory canopy cover (percent)		56
Overstory tree cover by species (percent)	JUSC	18
	POAN2	38
Tree Density by species	JUSC	100/ha
	POAN2	300/ha
Avg. tree DBH by species (cm)	JUSC	16.0
	POAN2	26
Avg. tree height by species (m)	JUSC	4.9
	POAN2	9.1
Snag Density		0
Understory height (m)	#Points with veg	7 of 10
	Min	0.05

	Max Avg	0.4 0.18
Total understory cover by species (percent)	UNKG2 JUNCU UNKG1 F1 GABO LIGUS2, TARAX, RHTR	32 24 18 8 6 <5
Ground surface covered by live understory vegetation (percent)		80
Ground surface covered by litter (percent)		94

Comments: No comments.

Recommendations: No action required.

Riparian Community Occurrence Three-Mile-2 Canyon



Photographs 17 and 18: Riparian occurrence Three-Mile-2 Canyon site facing east and west, respectively.

Community Type: Mixed conifer – Box Elder / Gambel Oak Woodland (Mixed Conifer – *Acer negundo* / *Quercus gambelii* Woodland)

Length: 1,168 m

Functional Condition: Functional

Data Summary:

Plot: Three-Mile-2 Canyon 6/15/2011

Measurement		Value
Width of riparian occurrence (m)		12

Avg. width of unvegetated stream channel (m)		1.4
Total overstory canopy cover (percent)		48
Overstory tree cover by species (percent)	ACNE PIPO PSME QUGA	18 10 8 12
Tree Density by species	ABCO SAEX	300/ha 400/ha
Avg. tree DBH by species (cm)	ABCO SAEX	16 3.2
Avg. tree height by species (m)	ABCO SAEX	13 4.3
Snag Density		0
Understory height (m)	#Points with veg Min Max Avg	5 of 10 0.1 1 0.4
Total understory cover by species (percent)	BEFE UNKG1 RONE1 BOGR, F1, POFR2, QUGA, RHTR, TORA	10 16 6 6 <5
Ground surface covered by live understory vegetation (percent)		42
Ground surface covered by litter (percent)		96

Comments: No comments

Recommendations: No required actions

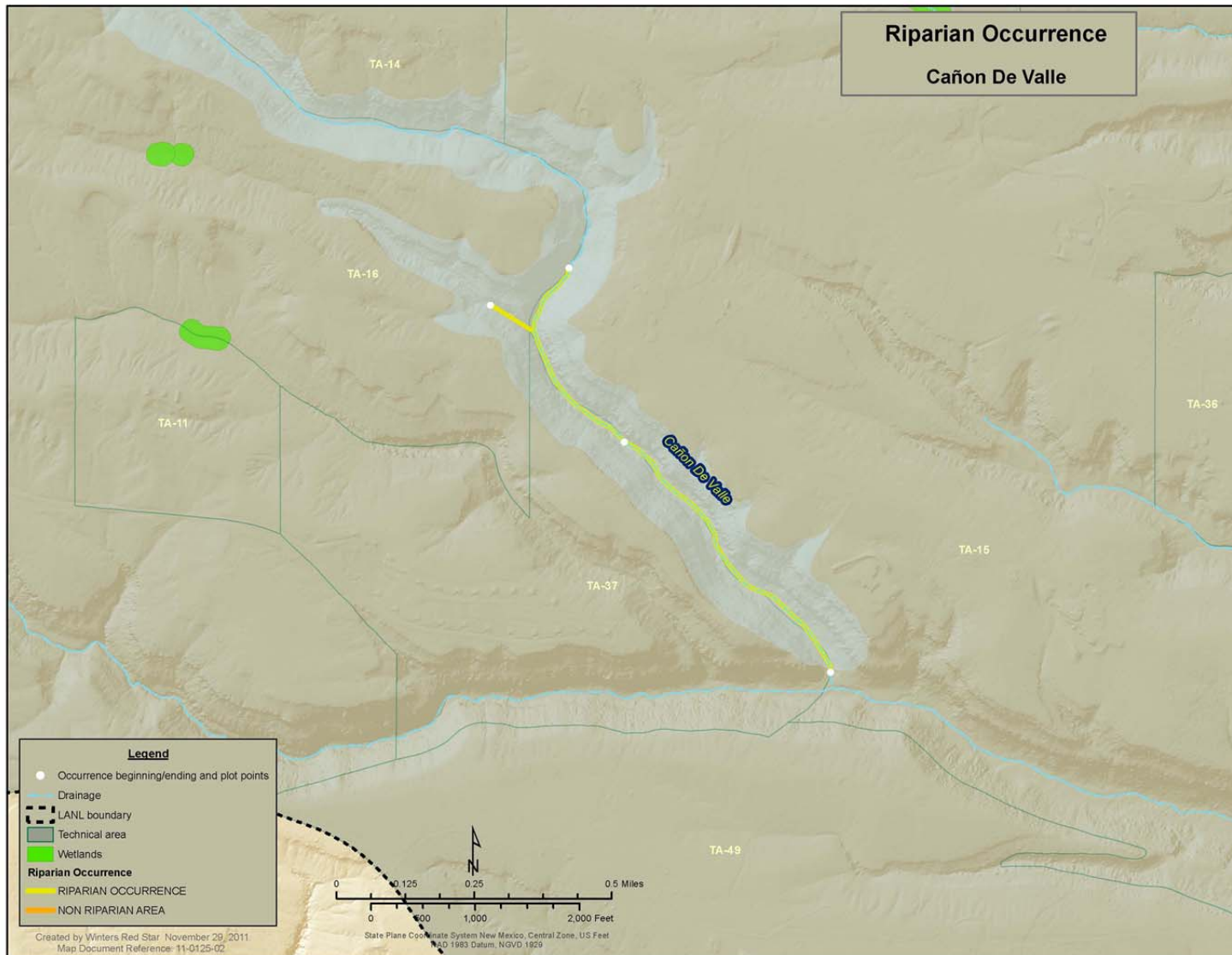


Figure 3: Riparian occurrences surveyed in Cañon de Valle in 2011

Cañon de Valle

In 2011 LANL biologists completed an inventory of riparian community occurrences in Canyon de Valle.

Riparian Community Occurrence Canyon de Valle



Photographs 19 and 20: Riparian occurrence site Canyon de Valle facing east and west, respectively.

Community Type: Mixed Conifer – Box Elder / Gambel Oak Forest (Mixed Conifer – *Acer negundo* / *Quercus gambelii* Forest)

Length: 1,585 m

Functional Condition: Functional

Data Summary:

Plot: Cañon de Valle 6/13/2011

Measurement		Value
Width of riparian occurrence (m)		18
Avg. width of unvegetated stream channel (m)		1.7
Total overstory canopy cover (percent)		80
Overstory tree cover by species (percent)	ACNE	20
	PSME	48
	QUGA	12
Tree Density by species	ACNE	200/ha
Avg. tree DBH by species (cm)	ACNE	8.5
Avg. tree height by species (m)	ACNE	6.1
Snag Density		100/ha
Understory height (m)	#Points with veg	8 of 10
	Min	0.1
	Max	1.0
	Avg	0.46

Total understory cover by species (percent)	UNKG1 THFE POFR2 PAMY, CLCOC2, GABO, UNKG2, F1, ACNE, ACGL	54 18 8 <5
Ground surface covered by live understory vegetation (percent)		74
Ground surface covered by litter (percent)		86

Comments: No Comments

Recommendations: No required actions

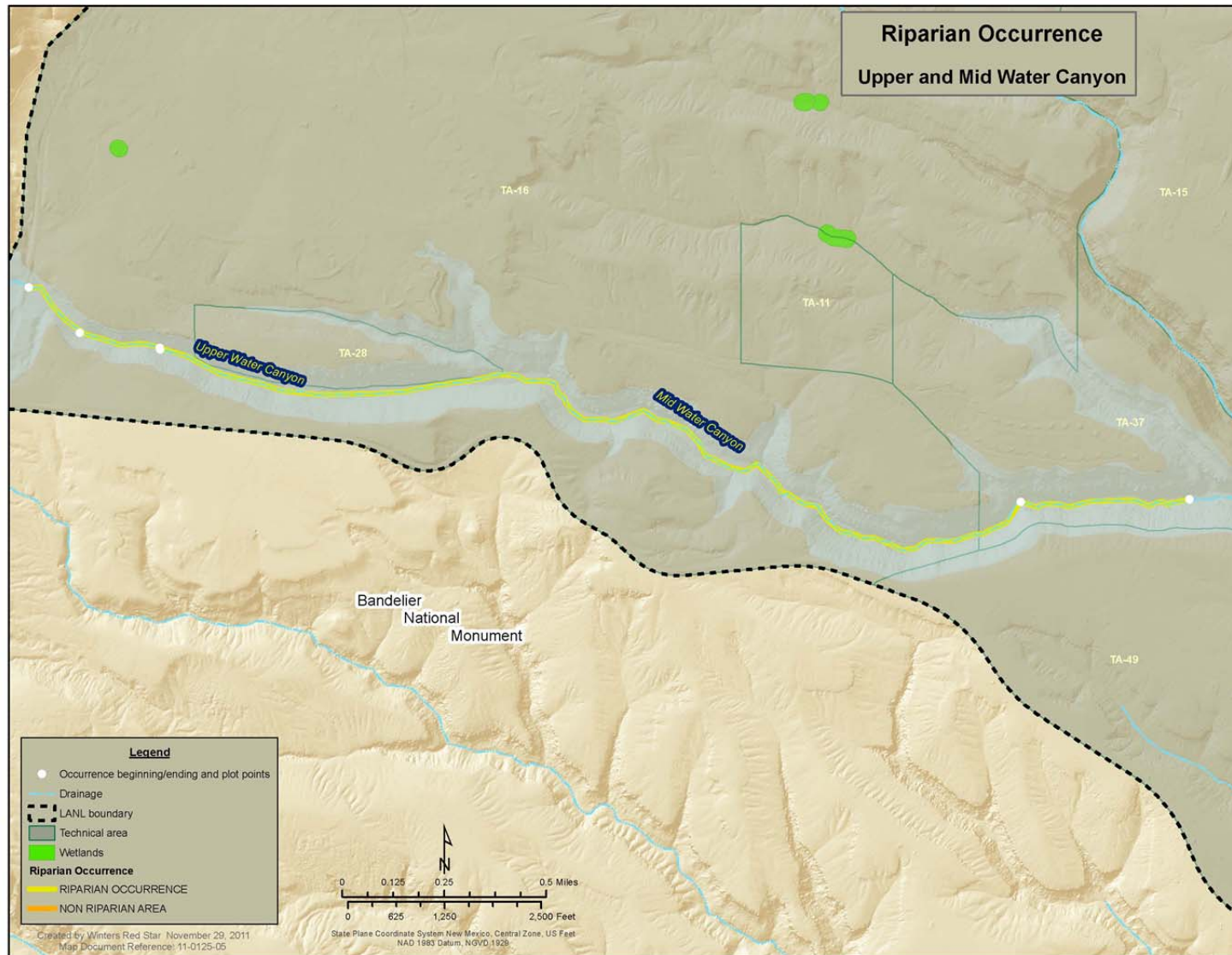


Figure 4: Riparian occurrences surveyed in Upper and Middle Water Canyon in 2011

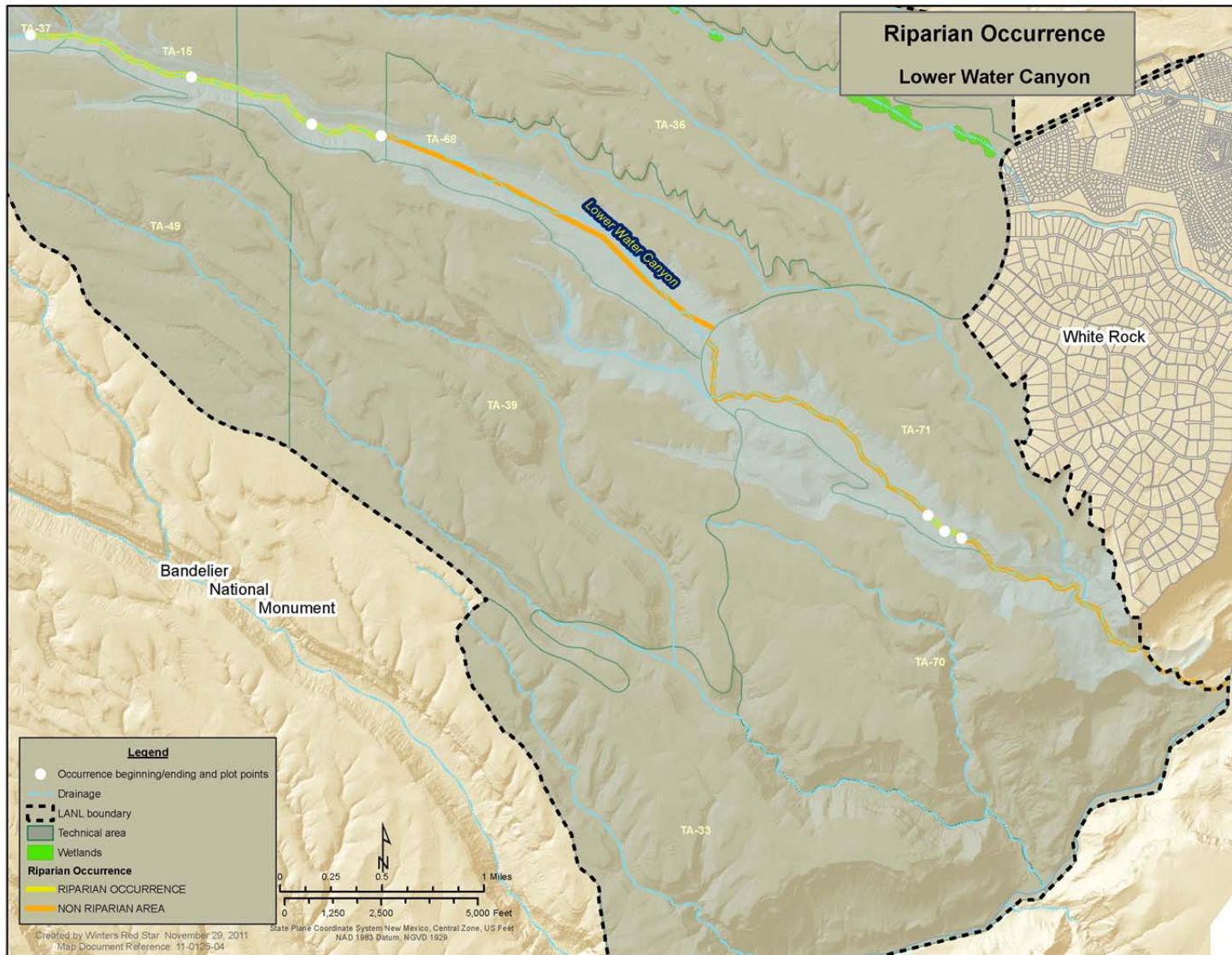


Figure 5: Riparian occurrences and non-riparian surveyed in Lower Water Canyon in 2011

Water Canyon

In 2008 LANL biologists completed an inventory of 25 percent of Water Canyon situated within Laboratory boundaries. In 2011 LANL biologists completed an inventory of the 75 percent of Water Canyon within Laboratory boundaries; inventory of Water Canyon is complete. Areas surveyed include Upper, Middle and Lower Water Canyon.

Riparian Community Occurrence Site Upper Water Canyon



Photographs 21 and 22: Riparian occurrence site Upper Water Canyon facing east and west, respectively.

Community Type: Water Birch – Mixed Conifer / Gambel Oak Forest (*Betula occidentalis* – Mixed Conifer / *Quercus gambelii* Forest)

Length: 4,438 m

Functional Condition: Functional

Data Summary:

Plot Upper Water Canyon 8/16/2011

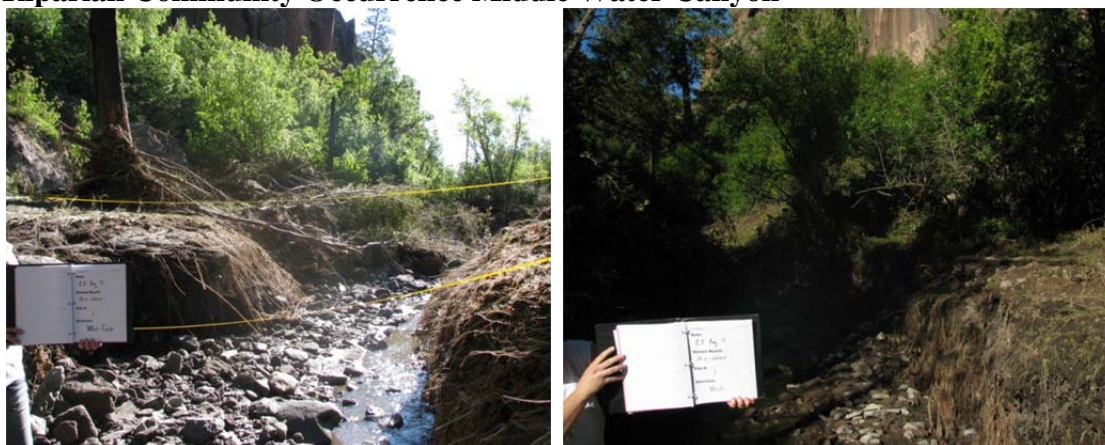
Measurement		Value
Width of riparian occurrence (m)		15
Avg. width of unvegetated stream channel (m)		2.2
Total overstory canopy cover (percent)		88
Overstory tree cover by species (percent)	BEOC	34
	PSME	22
	ABCO	12
	QUGA	12
Tree Density by species	ABCO	200
	BEOC	200
	POTR2	300
	PSME	200
Avg. tree DBH by species (cm)	ABCO	22

	BEOC	10
	POTR2	5.5
	PSME	8.5
Avg. tree height by species (m)	ABCO	13
	BEOC	7.3
	POTR2	5.1
	PSME	4.6
Snag Density		200
Understory height (m)	#Points w/ veg	8 of 10
	Min	0.05
	Max	0.5
	Avg	0.24
Total understory cover by species (percent)	UNKG1	20
	BROX	16
	F1	16
	THFE	14
	EQUIS	8
	POFE	8
	RUST	6
	GERX, MEAR, OXME	<5
Ground surface covered by live understory vegetation (percent)		66
Ground surface covered by litter (percent)		86

Comments: Adjacent upland watershed was burned in the Las Conchas fire (June 2011) and is contributing to riparian-wetland degradation.

Recommendations: Consider stabilizing adjacent upland.

Riparian Community Occurrence Middle Water Canyon



Photographs 23 and 24: Riparian occurrence site Middle Water Canyon facing east and west, respectively.

Community Type: Box Elder –Water Birch / *Poa* sp. Forest (*Acer negundo* – *Betula occidentalis* / *Poa* sp. Forest)

Length: 596 m

Functional Condition: Functional

Data Summary:

Plot: Middle Water Canyon 8/23/2011

Measurement		Value
Width of riparian occurrence (m)		15
Avg. width of unvegetated stream channel (m)		3.4
Total overstory canopy cover (percent)		62
Overstory tree cover by species (percent)	ACNE	56
	BEOC	6
Tree Density by species	ACNE	500/ha
Avg. tree DBH by species (cm)	ACNE	15
Avg. tree height by species (m)	ACNE	8.5
Snag Density		0
Understory height (m)	#Points with veg	2 of 10
	Min	0.1
	Max	0.12
	Avg	0.11
Total understory cover by species (percent)	POFE	22
	BROX, BRRU2, F1	<5
Ground surface covered by live understory vegetation (percent)		26
Ground surface covered by litter (percent)		0

Comments: Adjacent upland watershed was burning in Las Conchas fire (June 2011) and is contributing to riparian-wetland degradation through flooding and soil/debris deposition as well as channel incision and bank collapse.

Recommendations: Consider stabilizing adjacent upland.

Riparian Community Occurrence Lower Water Canyon 1

Photographs 25 and 26: Riparian occurrence site Lower Water Canyon Plot 1 facing east and west, respectively.

Community Type: Ponderosa Pine – Box Elder / Brome sp. Woodland (*Pinus ponderosa* – *Acer negundo* / *Bromus* sp. Woodland)

Length: 956 m

Functional Condition: Functional

Data Summary:

Plot: Lower Water Plot 1 8/9/2011

Measurement		Value
Width of riparian occurrence (m)		25
Avg. width of unvegetated stream channel (m)		2.4
Total overstory canopy cover (percent)		36
Overstory tree cover by species (percent)	ACNE	18
	JUMO	8
	PIPO	10
Tree Density by species	ACNE	100/ha
Avg. tree DBH by species (cm)	ACNE	13
Avg. tree height by species (m)	ACNE	5.5
Snag Density		0
Understory height (m)	#Points with veg	3 of 10
	Min	0.1
	Max	0.5
	Avg	0.23
Total understory cover by species (percent)	G1	16
	F1	12
	OXVI	8
Ground surface covered by live understory vegetation (percent)		36

Ground surface covered by litter (percent)		76
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Comments: Adjacent uplands watershed burned during the Las Conchas fire (June 2011) and is contributing to riparian-wetland degradation through flooding and soil/debris deposition.

Recommendations: Consider stabilizing adjacent uplands.

Riparian Community Occurrence Lower Water Canyon 2



Photographs 27 and 28: Riparian occurrence site Lower Water Canyon Plot 2 facing east and west, respectively.

Mixed Conifer – Box Elder / Fendler's Barberry – Skunkbush Sumac Forest (Mixed Conifer – *Acer negundo* / *Berberis fendleri* – *Rhus trilobata* Forest)

Length: 2,076 m

Functional Condition: Functional

Data Summary:

Plot: Lower Water Plot 2 8/9/2011

Measurement		Value
Width of riparian occurrence (m)		15
Avg. width of unvegetated stream channel (m)		1.3
Total overstory canopy cover (percent)		82
Overstory tree cover by species (percent)	ACNE	46
	BEOC	14
	POAN2	12
	PSME	10
Tree Density by species	POAN2	400/ha
	PSME	200/ha
Avg. tree DBH by species (cm)	POAN2	3.2

	PSME	13
Avg. tree height by species (m)	POAN2	3.9
	PSME	8.5
Snag Density		0
Understory height (m)	#Points with veg	5 of 10
	Min	0.1
	Max	0.2
	Avg	0.18
Total understory cover by species (percent)	BEFE	28
	G1	24
	RHTR	22
	THFE, TARAX,	
	PAVI, TORA,	
	GABO, F1,	
	CLCOC2, 2MOSS	<5
Ground surface covered by live understory vegetation (percent)		68
Ground surface covered by litter (percent)		88

Comments: Adjacent upland watershed was burned in the Las Conchas fire (June 2011) and is contributing to riparian-watershed degradation including flooding, and soil deposition. Also, there is road encroachment.

Recommendations: Consider stabilizing the adjacent uplands.

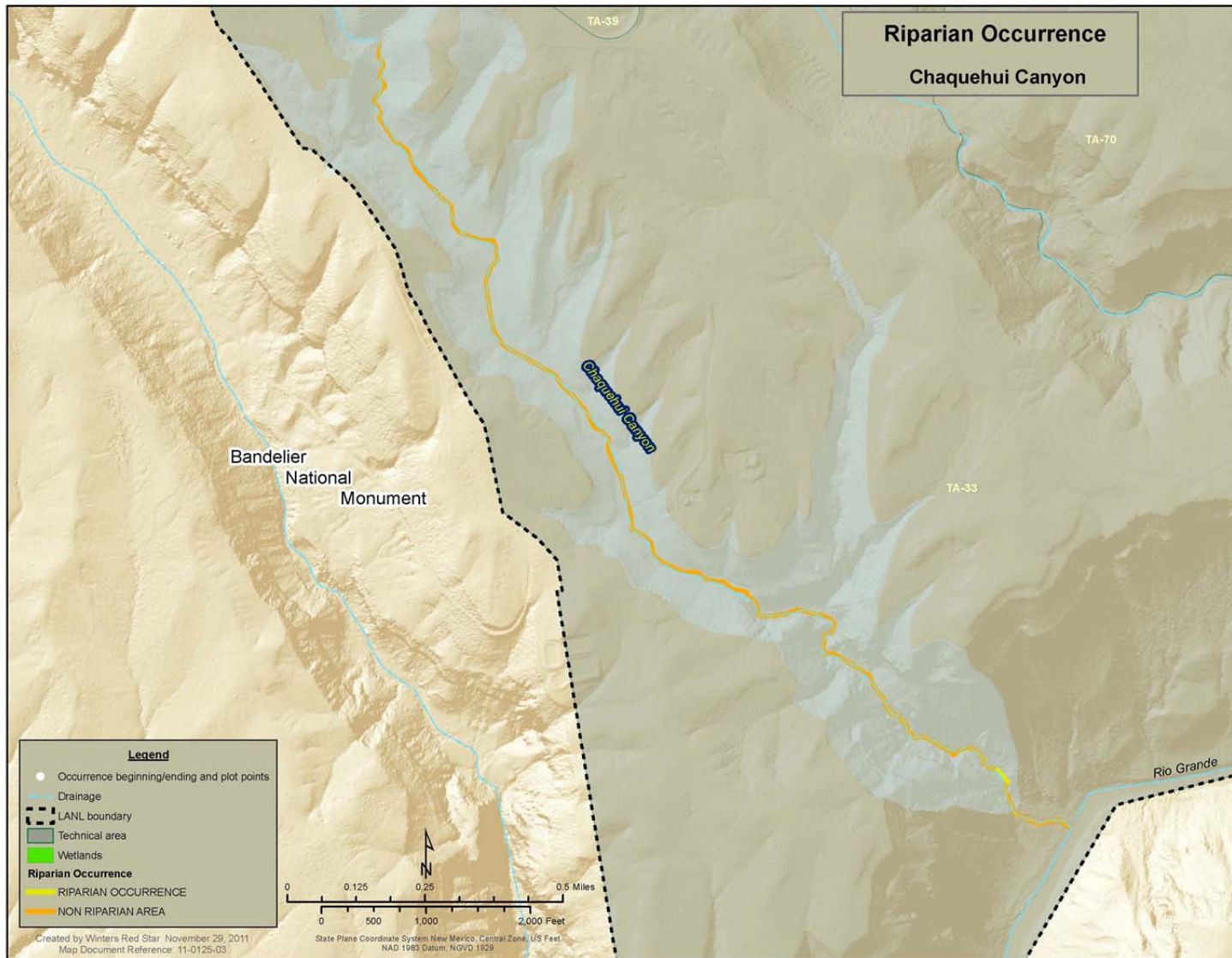


Figure 6: Riparian occurrence and non-riparian surveyed in Chaquehui Canyon in 2011

Chaquehui Canyon

Riparian Community Occurrence Chaquehui Canyon

In 2011 LANL biologists completed an inventory of Chaquehui Canyon. Riparian was identified in a 5mx50m strip of very dense habitat and large boulder substrate. No vegetation plot was taken.

Community Type: Box Elder –Narrow-leaf Cottonwood Forest (*Acer negundo* – *Populus angustifolia* Forest)

Functional Condition: Functional- At Risk

Comments: Disturbances influencing the current riparian area function include upstream channel conditions, namely, floodplain and channel characteristics are inadequate to dissipate high flow energy. There is inadequate riparian-wetland vegetative cover to protect banks and dissipate energy during high flows. There are exotic plants, including Salt Cedar (*Tamarisk* spp.), Russian olive (*Elaeagnus angustifolia*) and Siberian elm (*Ulmus pumila*). In addition, there was degradation due to feral cattle.

Recommendations: Consider exotic plant and feral animal removal. Consider this riparian community occurrence for in-channel placement of mechanical obstacles (such as snags) that would reduce flow rates.

Ancho Canyon

In 2008 LANL biologists completed an inventory of 70 percent of Ancho Canyon within Laboratory boundaries and recorded 1,143 m of riparian habitat. In 2011 LANL biologists completed the remaining inventory of Ancho Canyon within LANL boundaries. Areas surveyed in 2011 included the upper reach of North Ancho Canyon. No riparian was found in 2011.

DP Canyon

In 2008 LANL biologists completed an inventory of 100 percent of areas of DP Canyon located within Laboratory property. In 2011 LANL biologists re-visited one small section near the confluence of DP Canyon and LA Canyon and confirmed that there is no riparian along that stretch.

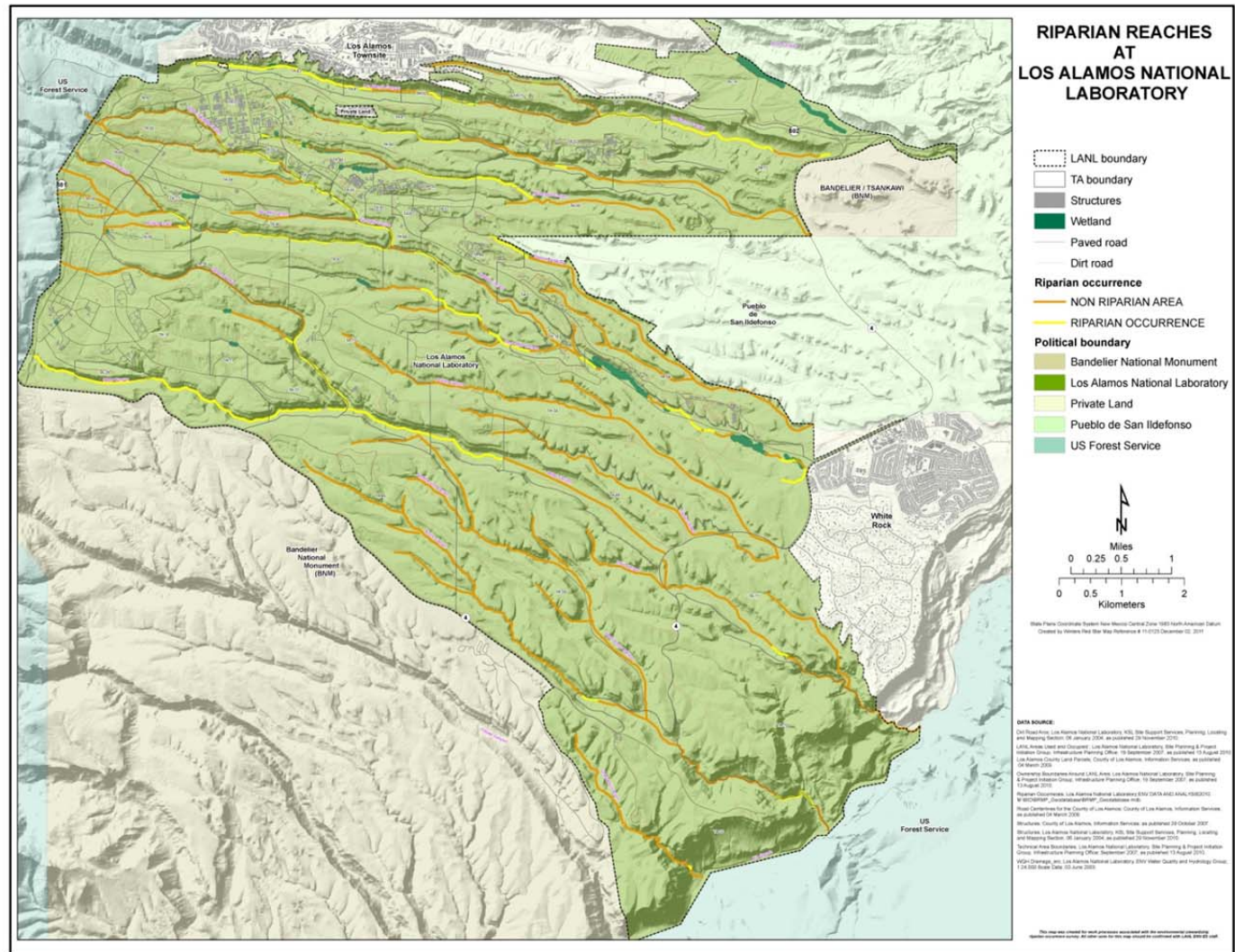


Figure 7: Map showing all riparian occurrences, non-riparian stretches and delineated wetlands within LANL

Summary

A total length of 36.7 kilometers of riparian habitat were inventoried within LANL boundaries between 2007 and 2011. The following canyons and lengths of riparian habitat were surveyed and inventoried between 2007 and 2011. Water Canyon (9,669 m), Los Alamos Canyon (7,131 m), Pajarito Canyon (6,009 m), Mortandad Canyon (3,110 m), Two-Mile Canyon (2,680 m), Sandia Canyon (2,181 m), Three-Mile Canyon (1,883 m), Canyon de Valle (1,835 m), Ancho Canyon (1,143 m), Cañada del Buey (700 m), Sandia Canyon (221 m), DP Canyon (159 m) and Chaquehui Canyon (50 m). Effluent Canyon, Fence Canyon and Potrillo Canyon were surveyed but no areas of riparian habitat were found.

Stretches of inventoried riparian habitat were classified for prioritization of treatment, if any was recommended. High priority sites included stretches of Mortandad Canyon, LA Canyon, Pajarito Canyon, Two-Mile Canyon, Sandia Canyon and Water Canyon. Recommended treatment for high priority sites includes placement of objects into the stream channel to encourage sediment deposition, elimination of channel incision, and to expand and slow water flow across the floodplain. Additional stretches were classified as lower priority, and, for other sites it was recommended that feral cattle and exotic plants be removed to aid in riparian habitat recovery.

In June 2011 the Las Conchas Wildfire burned over 150,000 acres of land in the Jemez Mountains and surrounding areas. The watersheds above LA Canyon, Water Canyon and Pajarito Canyon were burned in the Las Conchas Wildfire and flooding and habitat alteration were observed in these canyon bottoms (Wright 2011). Post fire status of lower priority areas may change to higher priority for some of the sites surveyed prior to the Las Conchas Wildfire, due to changes in vegetation cover in the adjacent upland watershed.

Future Work

Riparian area surveys were completed across LANL property during 2007, 2008, 2009 and 2011 and this allowed creation of GIS layers with locations of sensitive habitats. Future riparian work will include development of procedures for updating this information, as needed. Additional future work would include development and implementation of LANL-specific best management practices and plans for protection and retention of wetlands, floodplains and riparian areas, including consideration of outfall and storm water management.

Additionally, riparian areas that were surveyed in 2007, 2008 and 2009 may need to be re-surveyed following the Los Conchas Wildfire to determine any change in status or habitat destruction following flooding due to burning in adjacent upland watersheds.

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APPENDIX 1

Species codes used in this report

CODE	GENUS	SPECIES	COMMON NAME
2MOSS	Moss		unknown moss
ABCO	Abies	concolor	white fir
ACGL	Acer	glabrum	Rocky Mountain maple
ACNE	Acer	negundo	boxelder
AGTR	Agropyron	trachycaulum	slender wheatgrass
ARBI	Artemisia	bigelovii	Bigelow sage
ARCA1	Artemisia	cana	silver sagebrush
ARDR	Artemisia	dracunculus	tarragon
BEFE	Berberis	fendleri	Colorado barberry
BEOC	Betula	occidentalis	water birch
BOGR	Bouteloua	gracilis	blue grama
BRCI	Bromus	ciliatus	fringed brome
BROX	Bromus		brome species, unidentified
BRRU2	Bromus	rubens	red brome
CLCOC2	Clematis	columbiana	rock clematis
EQUIS	Equisetum		unknown horsetail species
F1			unknown forb species
FAPA	Fallugia	paradoxa	apache plume
FONE	Forestiera	neomexicana	New Mexico olive
G1	Grass		unknown grass species
GABO	Galium	boreale	northern bedstraw
GERX	Geranium		unknown geranium species
JUMO	Juniperus	monosperma	oneseed juniper
JUNCU			unknown rush species
JUSC	Juniperus	scopulorum	Rocky Mountain juniper
LIGUS2	Ligustrum		unknown privet species
MEAR	Mentha	arvensis	field mint
MUMO	Muhlenbergia	montana	mountain muhly
OXME	Oxalis	alpina	alpine woodsorrel
OXVI	Oxalis	violacea	violet woodsorrel
PAMY	Pachystima	myrsinites	Oregon boxleaf
PAVI	Panicum	virgatum	switchgrass
PIPO	Pinus	ponderosa	Ponderosa pine
POAN2	Populus	angustifolia	narrowleaf cottonwood
POFE	Poa	fendleriana	muttongrass
POFR2	Populus	fremontii	Rio Grande cottonwood
PRVI	Prunus	virginiana	chokecherry

PSME	Psuedotsuga	menziesii	Douglas Fir
QUGA	Quercus	gambelii	Gambel oak
RHTR	Rhus	trilobata	skunkbush sumac
RONE1	Robinia	neomexicana	New Mexico locust
RUST	Rubus	strigosus	red raspberry
RUTR	Rumex	triangulivalvis	Mexican Dock
SAEX	Salix	exigua	coyote willow
SCSC	Schizachyrium	scoparium	little bluestem
TARAX	Taraxacum		dandelion, species unknown
THFE	Thalictrum	fendlerii	Fendler's meadowrue
TORA	Toxicodendron	radicans	poison ivy
UNK1			unknown
UNKG1			unknown grass, tentatively identified as mountain muhly in this report
UNKG2			unknown grass
VETH	Verbascum	thapsus	common mullein